

Appln No. 09/966,572
Amdt date November 8, 2004
Reply to Office action of August 6, 2004

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

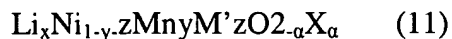
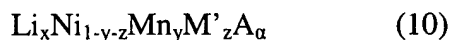
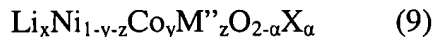
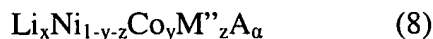
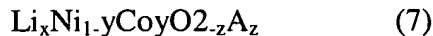
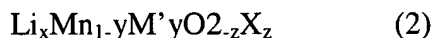
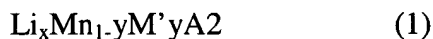
Listing of Claims:

1. (currently amended) A positive active material for a rechargeable lithium battery comprising:

a core comprising a lithiated compound; and

at least two ~~non-lithiated metal or metalloid~~ different oxide layers formed on the core wherein the oxides are selected from the group consisting of oxides of Mg, Al, Co, K, Na, Ca, Si, Ti, Sn, V, Ge, Ga, B, As, and Zr.

2. (original) The positive active material according to claim 1, wherein the lithiated compound is at least one compound selected from the group consisting of compounds represented by the formulas 1 to 11:



wherein:

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$$0.95 \leq x \leq 1.1, 0 \leq y \leq 0.5, 0 \leq z \leq 0.5, 0 < \alpha \leq 2,$$

M is Ni or Co,

M' is at least one element selected from the group consisting of Al, Ni, Co, Cr, Fe, Mg, Sr, V, Sc, Y, La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Ac, Th, and Pa,

M'' is at least one element selected from the group consisting of Al, Cr, Mn, Fe, Mg, Sr, V, Sc, Y, La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Ac, Th, and Pa,

A is selected from the group consisting of O, F, S, and P, and

X is selected from the group consisting of F, S and P.

3. (currently amended) The positive active material for a rechargeable lithium battery according to claim 1, wherein the ~~metal or metalloid~~ oxide layers each range from 2×10^{-5} to 1 wt% based on the weight of the positive active material.

4. (currently amended) The positive active material for a rechargeable lithium battery according to claim 3, wherein the ~~metal or metalloid~~ oxide layers each range from 0.001 to 1 wt% based on the weight of the positive active material.

5. (canceled)

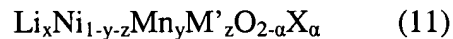
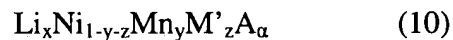
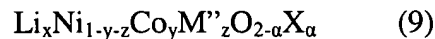
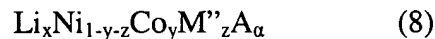
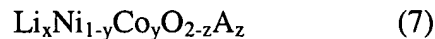
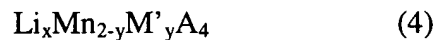
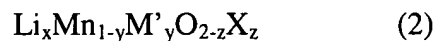
6. (canceled)

7. (currently amended) A positive active material for a rechargeable lithium battery comprising:

a core comprising at least one lithiated compound; and

at least two ~~non-lithiated~~ different surface-treatment ~~metal or metalloid~~ oxide layers formed sequentially on the core wherein the oxides are selected from the group consisting of oxides of Mg, Al, Co, K, Na, Ca, Si, Ti, Sn, V, Ge, Ga, B, As, and Zr.

8. (original) The positive active material according to claim 7, wherein the lithiated compound is at least one compound selected from the group consisting of compounds represented by the formulas 1 to 11:



wherein:

$$0.95 \leq x \leq 1.1, 0 \leq y \leq 0.5, 0 \leq z \leq 0.5, 0 < \alpha \leq 2,$$

M is Ni or Co,

M' is at least one element selected from the group consisting of Al, Ni, Co, Cr, Fe, Mg, Sr, V, Sc, Y, La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Ac, Th, and Pa,

M'' is at least one element selected from the group consisting of Al, Cr, Mn, Fe, Mg, Sr, V, Sc, Y, La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Ac, Th, and Pa,

A is selected from the group consisting of O, F, S, and P, and

X is selected from the group consisting of F, S, and P.

9. (currently amended) The positive active material according to claim 7, wherein the ~~metal or metalloid~~ oxide layers each range from 2×10^{-5} to 1 wt% based on the weight of the positive active material.

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10. (currently amended) The positive active material according to claim 9, wherein the ~~metal or metalloid~~ oxide layers each range from 0.001 to 1 wt% based on the weight of the positive active material.

11. (canceled)

12. (canceled)

13. (currently amended) A method of preparing a positive active material for a rechargeable lithium battery comprising:

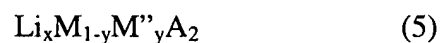
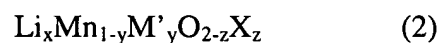
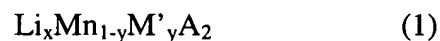
coating a lithiated compound with a first organic solution or [[an]] aqueous solution including at least one ~~non-lithiated metal or metalloid~~ oxide-forming compound; [[and]]

heat-treating the coated compound to form a first ~~metal or metalloid oxide~~ coating;

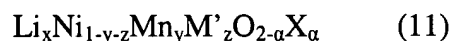
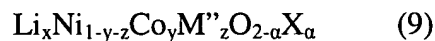
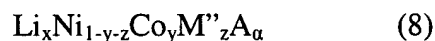
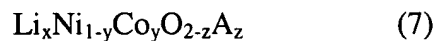
coating the lithiated compound with a second organic solution or [[an]] aqueous solution including at least one ~~non-lithiated metal or metalloid~~ oxide-forming compound; and

heat treating the coated compound to form a second ~~metal or metalloid~~ oxide coating wherein the oxides of the first and second oxide coatings are different from one another and each oxide is selected from the group consisting of oxides of Mg, Al, Co, K, Na, Ca, Si, Ti, Sn, V, Ge, Ga, B, As, and Zr.

14. (original) The method according to claim 13, wherein the lithiated compound is at least one compound selected from the group consisting of compounds represented by the formulas 1 to 11:



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wherein:

$$0.95 \leq x \leq 1.1, 0 \leq y \leq 0.5, 0 \leq z \leq 0.5, 0 < \alpha \leq 2,$$

M is Ni or Co,

M' is at least one element selected from the group consisting of Al, Ni, Co, Cr, Fe, Mg, Sr, V, Sc, Y, La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Ac, Th, and Pa,

M'' is at least one element selected from the group consisting of Al, Cr, Mn, Fe, Mg, Sr, V, Sc, Y, La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Ac, Th, and Pa,

A is selected from the group consisting of O, F, S, and P, and

X is selected from the group consisting of F, S, and P.

15. (currently amended) The method according to claim 13, wherein the ~~metal or metalloid~~ oxide layers each comprise from 0.1 to 50 wt% based on the weight of the positive active material.

16. (currently amended) The method according to claim 15, wherein the ~~metal or metalloid~~ oxide layers each comprise from 1 to 20 wt% based on the weight of the positive active material.

17. (canceled)

18. (canceled)

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19. (previously presented) The method according to claim 13, wherein at least one of the heat-treatment steps is performed at a temperature ranging from 200 to 800°C for 1 to 20 hours.

20. (previously presented) The method according to claim 13, wherein at least one of the heat-treatment steps is performed under flowing dry air.

21. (canceled)

22. (original) The method according to claim 13, wherein the coating and the heat-treatment steps are performed three or more times.

23. (currently amended) A positive active material for a rechargeable lithium battery comprising:

a core comprising a lithium-cobalt chalcogenide compound; and

at least two ~~non-lithiated metal or metalloid~~ different oxide layers sequentially formed on the core, wherein one of the two ~~metal or metalloid~~ oxide layers comprises Al₂O₃ and the other of the two oxide layers is selected from the group consisting of oxides of Mg, Co, K, Na, Ca, Si, Ti, Sn, V, Ge, Ga, B, As, and Zr.

24. (currently amended) The positive active material of claim 23, wherein the content of Al of the ~~metal~~ oxide layer ranges from 2×10^{-5} to 2 percent by weight based on the weight of the positive active material.

25. (currently amended) The positive active material of claim 24, wherein the content of Al of the ~~metal~~ oxide layer ranges from 0.001 to 2 percent by weight based on the weight of the positive active material.

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26. (currently amended) A positive active material for a rechargeable lithium comprising:

a core comprising a lithium–manganese or lithium-cobalt chalcogenide compound; and

at least two different ~~non-lithiated metal or metalloid~~ oxide layers sequentially formed on the core, wherein one of the layers comprises an oxide of B and the other of the oxide layers comprises an oxide selected from the group consisting of oxides of Mg, Al, Co, K, Na, Ca, Si, Ti, Sn, V, Ge, Ga, As, and Zr.

27. (currently amended) The positive active material of claim 26, wherein the content of B of the ~~metal~~ oxide layer ranges from 2×10^{-5} to 2 wt% based on the weight of the positive active material.

28. (currently amended) The positive active material of claim 27, wherein the content of B of the ~~metal~~ oxide layer ranges from 0.001 to 2 wt% based on the weight of the positive active material.